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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/522,569	11/17/2005	Shuhei Ogawa	033082M239	8765

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SMITH, GAMBRELL & RUSSELL
1850 M STREET, N.W., SUITE 800
WASHINGTON, DC 20036

EXAMINER

OLSEN, ALLAN W

ART UNIT	PAPER NUMBER
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1763

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/07/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/522,569

Applicant(s)

OGAWA ET AL.

Examiner

Allan Olsen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 November 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6,326,302 (Joubert) in view of US Patent 6,869,542 (Desphande) and further in view of US Patent 6,069,090 (Eriguchi).

Joubert teaches using an etchant comprising O₂ and NH₃ to etch an organic layer with an overlying SiO₂ hard mask. Joubert teaches using an O₂: NH₃ flow ratio within the claimed range (see claim 5).

Joubert does not teach using a Si-containing organic material as the overlying hard mask. Joubert does not teach the residence time of plasma species within the plasma zone. Joubert does not teach controlling the CD shift by adjusting the ratio of O₂ and NH₃.

Desphande teaches using a Si-containing organic material as a hard mask when etching an underlying organic material.

Eriguchi teaches that CD shift can be controlled by controlling both the pressure within the plasma chamber and the total flow rate of plasma gases.

It would have been obvious to one skilled in the art to incorporate the hard mask of Desphande into the process of Joubert because Desphande teaches that organic based, Si-containing hard masks sputter less readily than SiO₂ and they offer tighter CD control than conventional hard masks (column 5, lines 1-57).

As taught by Desphande and Eriguchi and noted in applicant's specification it is advantageous to reduce the critical dimension differences in an etching process. It would have been obvious to one skilled in the art to control the gas flow rate and chamber pressure, according to the teaching of Eriguchi, to reduce the critical dimension difference of Joubert's etching process. It would be obvious to optimize the pressure and flow rates of O₂ and NH₃ according to Eriguchi because Eriguchi teaches these to be result effective variables¹. In optimizing the pressure and gas flow rate, the plasma residence time would also be optimized.

¹ "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

In re Aller 105 USPQ 233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Response to Arguments

Applicant's arguments filed November 6, 2006 have been fully considered but they are not persuasive. Applicant states:

"Neither Joubert, Desphande nor Eriguchi teaches the residence time recited in claims 1 and 7. Eriguchi mentions a "time of residence" at col. 6, lines 26-34 but only in connection with the time of residence of the etch product over the etch surface, that varies depending upon an etch pattern. Eriguchi does not teach a residence time "represented by V/S having a value from 20 to 60 msec, where V (m^3) represents an effective processing space volume as a product of an area of the substrate and a distance between the electrodes, and S (m^3/sec) represents a gas exhaust velocity from the processing vessel", as recited in instant claims 1 and 7. Thus, the effects of the residence time on CD shift value, etching speed and amount of etching residue discussed in the instant specification are unexpected in view of the references cited in the Office Action."

The examiner notes that applicant's represent the claimed residence time as V/S , where S = gas exhaust velocity which is a parameter not often discussed in the bulk of the prior art literature. However, it is also noted that applicant's specification indicates that $S = p/Q$, where p = chamber pressure and Q = total gas flow rate. Chamber pressure and gas flow rates are more commonly disclosed. In fact, these are the very parameters that Eriguchi teaches controlling as a means to control the CD shift in an etching process. Therefore, Eriguchi does teach controlling residences time. Applicant dismisses Eriguchi's mention of residence time by stating:

"Eriguchi mentions a "time of residence" at col. 6, lines 26-34 but only in connection with the time of residence of the etch product over the etch surface"

However, the concepts of an etchant's residence time and an etch products' residence time are not divorced from one another. Clearly, Eriguchi teaches controlling flow rates and chamber pressure - the very parameters that applicant uses to define the etchant residence time. With respect to chamber pressure, it is noted that applicant's

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disclosure and Joubert both teach the upper limit of chamber pressure as 13.3 Pa (100 mTorr) while most of Eriguchi's examples are at a pressure of 100 mTorr (see page 10, lines 23-24 of applicant's specification, the sentence bridging columns 3 and 4 in Joubert and figures 7, 8, 10 and 15 of Eriguchi).

Applicant also argues: "[n]one of the references cited in the Office Action teaches or suggests the distance between electrodes recited in new claims 14 and 15. The examiner notes that Joubert teaches using conventional etching sources with specific mention of the LAM TCP and Applied Material PDS reactors. The examiner takes Official Notices that conventional etching sources, and the named reactors in particular, have an electrode spacing within the claimed 30 - 90 mm range.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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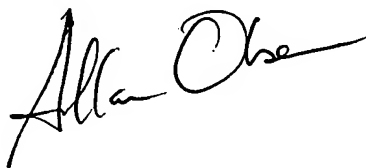
the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441.

The examiner can normally be reached on M, W and F: 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

A handwritten signature in black ink, appearing to read 'Allan Olsen', is written over a horizontal line.

Allan Olsen
Primary Examiner
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